GASTROINTESTINAL DIGESTIVE CARE

A SCIENTIFIC SUPPORT PAPER

Digestive Care achieved 92% protein digestibility - far exceeding the FEDIAF's 80% standard

West Pomeranian University of Technology, Szczecin, Poland - Feeding Study

CONTENTS

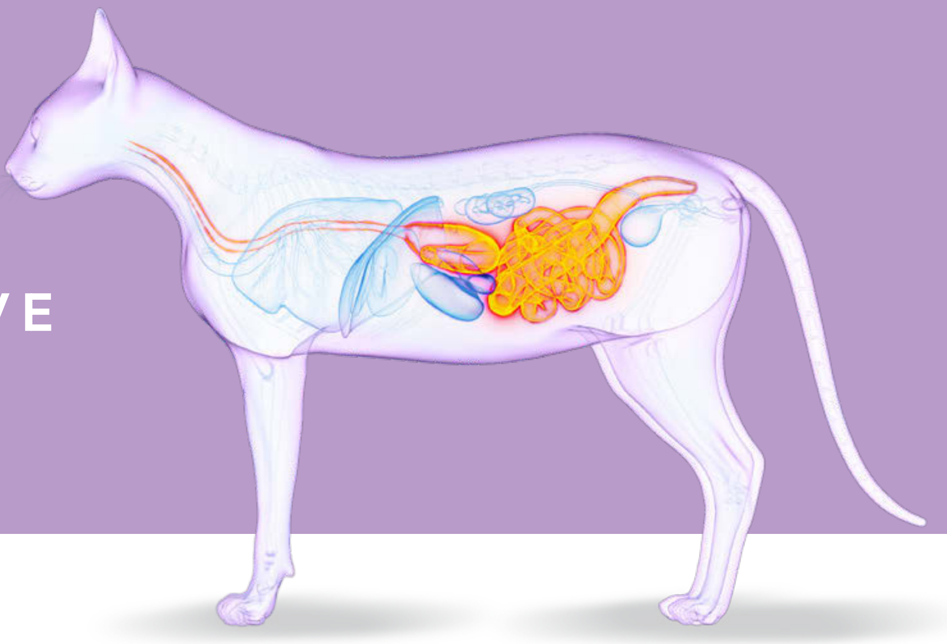
WHY IS DIGESTIVE HEALTH IMPORTANT FOR CATS?

A healthy digestive system is essential for a cat's overall wellbeing because it is responsible for breaking down food and absorbing vital nutrients required for energy production, growth, tissue maintenance, and repair (Hall et al., 2021).

When the gastrointestinal (GI) tract is functioning properly, it allows the cat to utilise proteins, fats, vitamins, and minerals efficiently—meaning even a high-quality diet cannot support health if digestion is compromised. In addition to nutrient absorption, the GI tract serves as a crucial protective barrier between the external environment and the internal systems of the cat. Approximately 70% of the cat's immune system is located within the gut, where a healthy mucosal barrier and balanced microbiota help prevent the entry of harmful substances, toxins, and potentially pathogenic organisms (German & Hall, 2010; WSAVA, 2020).

Digestive issues in cats can develop for many reasons, including stress, underlying illness, ingestion of unsuitable foods, inflammation, or sensitivities and allergies to certain dietary components (Moore, 2014). Disruptions to the gut microbiome—often caused by stress, dietary changes, or antibiotic use—can also contribute to digestive imbalance and disease (Suchodolski, 2016). Poor digestive health can lead to noticeable and sometimes severe discomfort. Common signs include loose stools or diarrhoea, vomiting, constipation, abdominal discomfort, bloating, and reduced appetite, all of which can negatively affect a cat's daily comfort and behaviour. These symptoms are among the most frequent reasons owners seek veterinary care, highlighting the importance of maintaining a stable and healthy digestive system to support long-term wellbeing (WSAVA, 2020; Moore, 2014).

IMPORTANT ROLES OF THE DIGESTIVE SYSTEM

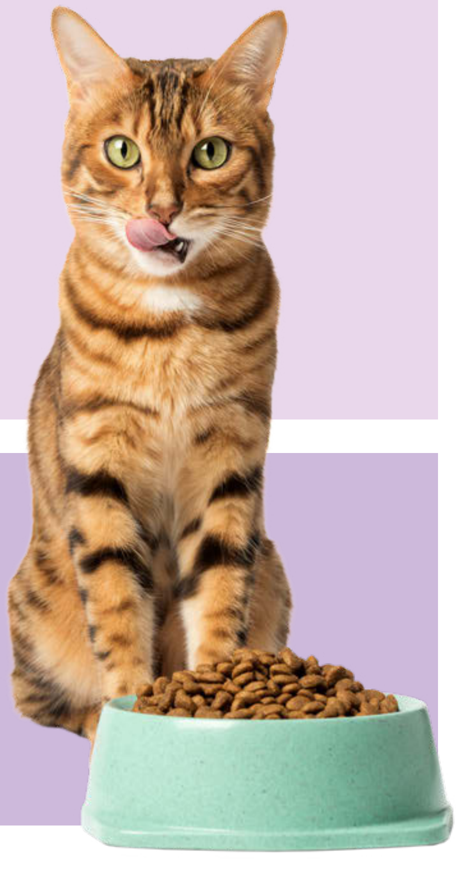


Cats, like all animals, require essential nutrients that cannot be synthesised by the body and must be obtained through the diet (Hall et al., 2021). The epithelial cells lining the gastrointestinal (GI) tract play a critical role in nutrient absorption, and their health is essential for effective digestion and utilisation of nutrients (German & Hall, 2010).

Cat foods are formulated with a variety of ingredients that provide a complex mix of nutrients. Macronutrients, such as proteins, fats, and carbohydrates, are present as large molecules that must be broken down through digestion before they can be absorbed. Micronutrients, including vitamins and minerals, are already in a form small enough to be absorbed but must reach the appropriate section of the digestive tract to be utilised effectively (WSAVA, 2020).

MECHANICAL DIGESTION

Digestion in cats begins with mechanical digestion, which occurs primarily in the mouth. Chewing (or mastication) breaks food into smaller pieces, increasing its surface area and facilitating the access of digestive enzymes released later in the GI tract (Moore, 2014). Unlike many omnivorous species, cats lack salivary amylase, meaning no carbohydrate-digesting enzymes are present in the mouth. This is consistent with their evolution as obligate carnivores, whose natural diet contains very little starch (Hall et al., 2021; German & Hall, 2010).



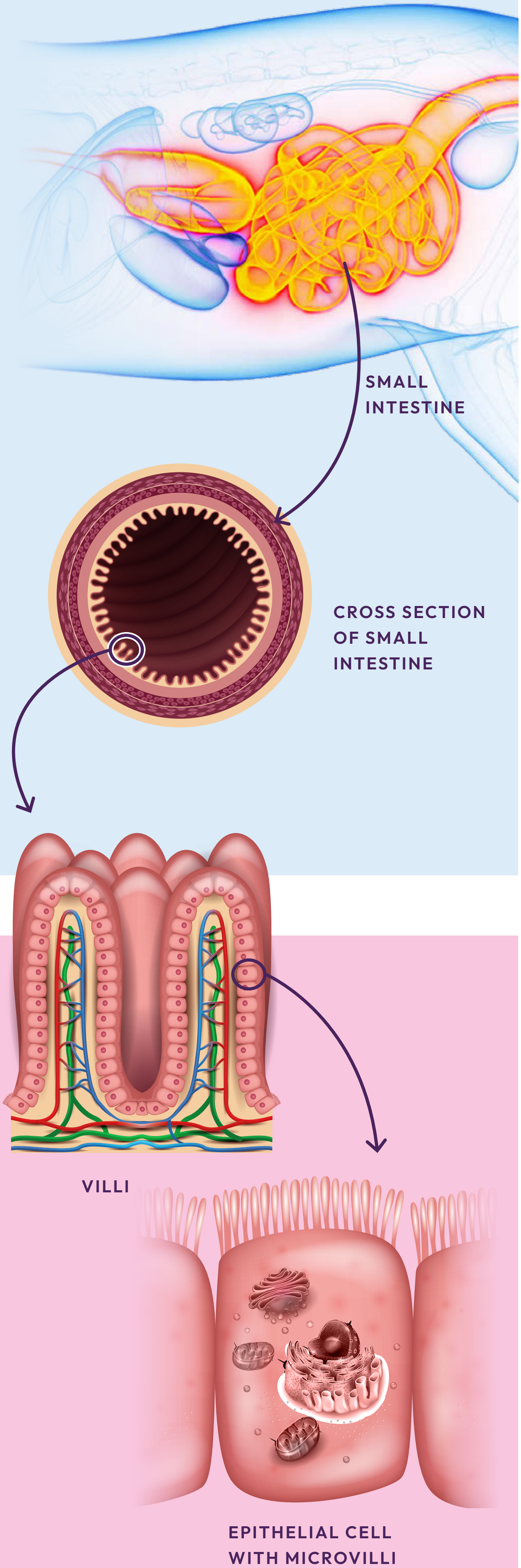
ENZYMATIC DIGESTION

Predominately enzymatic hydrolysis begins in the stomach, where gastric acid creates the low-pH environment necessary to activate pepsin, which starts breaking down dietary proteins. Partially digested food then enters the small intestine, where the pancreas secretes additional enzymes, including trypsin for proteins and lipase for fats (Hall et al., 2021; German & Hall, 2010; Suchodolski, 2016).

SMALL INTESTINE

In cats, digestion continues in the small intestine, where proteins, fats, and carbohydrates are broken down into peptides and amino acids, monoglycerides and fatty acids, and monosaccharides such as glucose and fructose, which can then be absorbed (Hall et al., 2021).

The small intestine is highly specialised for nutrient absorption. Its lining is folded into finger-like projections called villi, which are covered with microvilli on the epithelial cells (enterocytes), greatly increasing the surface area available for nutrient uptake. Nutrients are transported from the intestinal lumen into enterocytes via specific transport proteins, including amino acid transporters, PEPT1 for di- and tripeptides, sodium-glucose transporters, and fatty acid transport proteins (Goodman, 2010; Hall et al., 2021). The villi also contain a rich network of blood capillaries and lymphatic vessels (lacteals), allowing water-soluble nutrients such as amino acids, monosaccharides, and B vitamins to enter the blood for distribution to tissues, while fats and fat-soluble vitamins (A, D, E) are packaged into chylomicrons and transported via the lymphatic system (Hall et al., 2021). Unlike omnivores, cats naturally have very low levels of pancreatic amylase, limiting their ability to digest dietary starch efficiently and reflecting their evolution as obligate carnivores (German & Hall, 2010; Suchodolski, 2016).



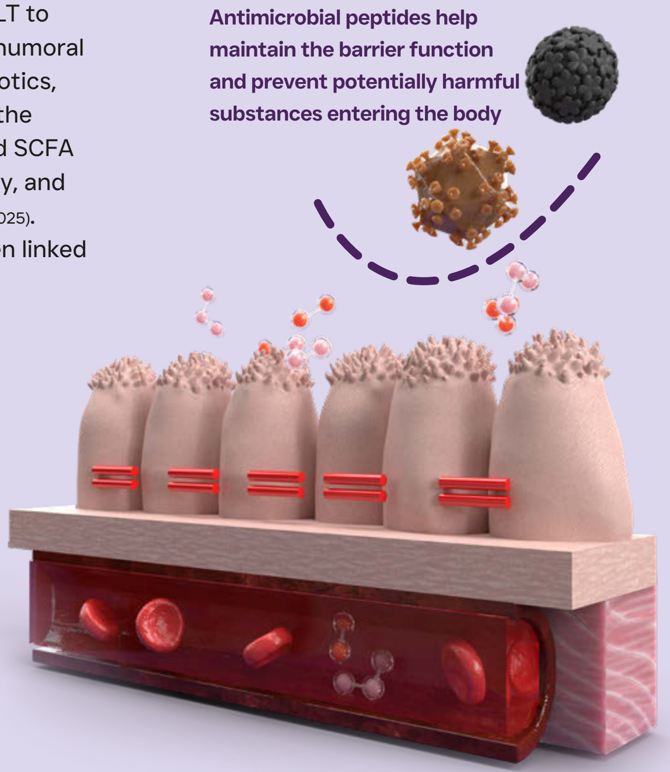
BARRIER FUNCTION

The intestinal epithelium also provides a physical and immunological barrier to protect cats from toxins and pathogenic microorganisms. The epithelium comprises enterocytes, goblet cells, enteroendocrine cells, and other specialised cells, anchored to a basement membrane and connected by tight junction proteins such as occludin, claudins, and zonula occludens (Chelakkot et al., 2018). Goblet cells secrete mucus, composed of glycoproteins (mucins), which acts as the first-line defence and contains antimicrobial peptides (AMPs) such as defensins and cathelicidins (Camilleri et al., 2019).

IMMUNE ROLES

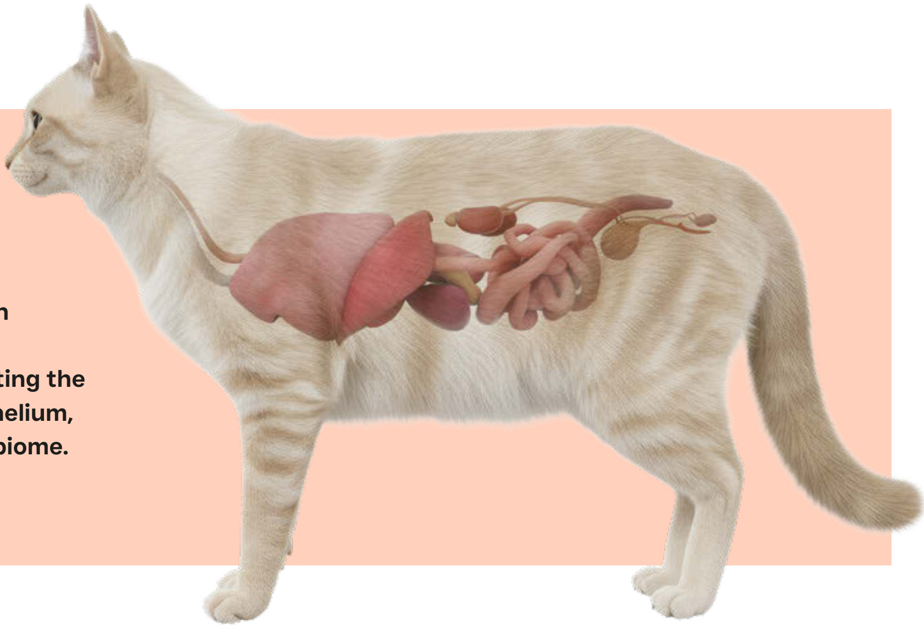
In cats, a significant portion of the immune system is located in the gut, particularly within the gut-associated lymphoid tissue (GALT), which plays a central role in immune surveillance and response (Lyu et al., 2020). Microbiota-derived metabolites, including short-chain fatty acids (SCFAs), engage GALT to regulate systemic immune balance, influencing both humoral and cellular immunity (Aguilar-Toalá et al., 2025). Dietary prebiotics, such as fermentable fibres, can selectively stimulate the growth of beneficial gut bacteria, leading to increased SCFA production, enhancement of epithelial barrier integrity, and improved gut immune function in cats (Aguilar-Toalá et al., 2025). Perturbations in the gut microbiome of cats have been linked to chronic enteropathies, suggesting that alterations in microbial ecosystems may impair gut immune function and barrier integrity (Drut et al., 2024).

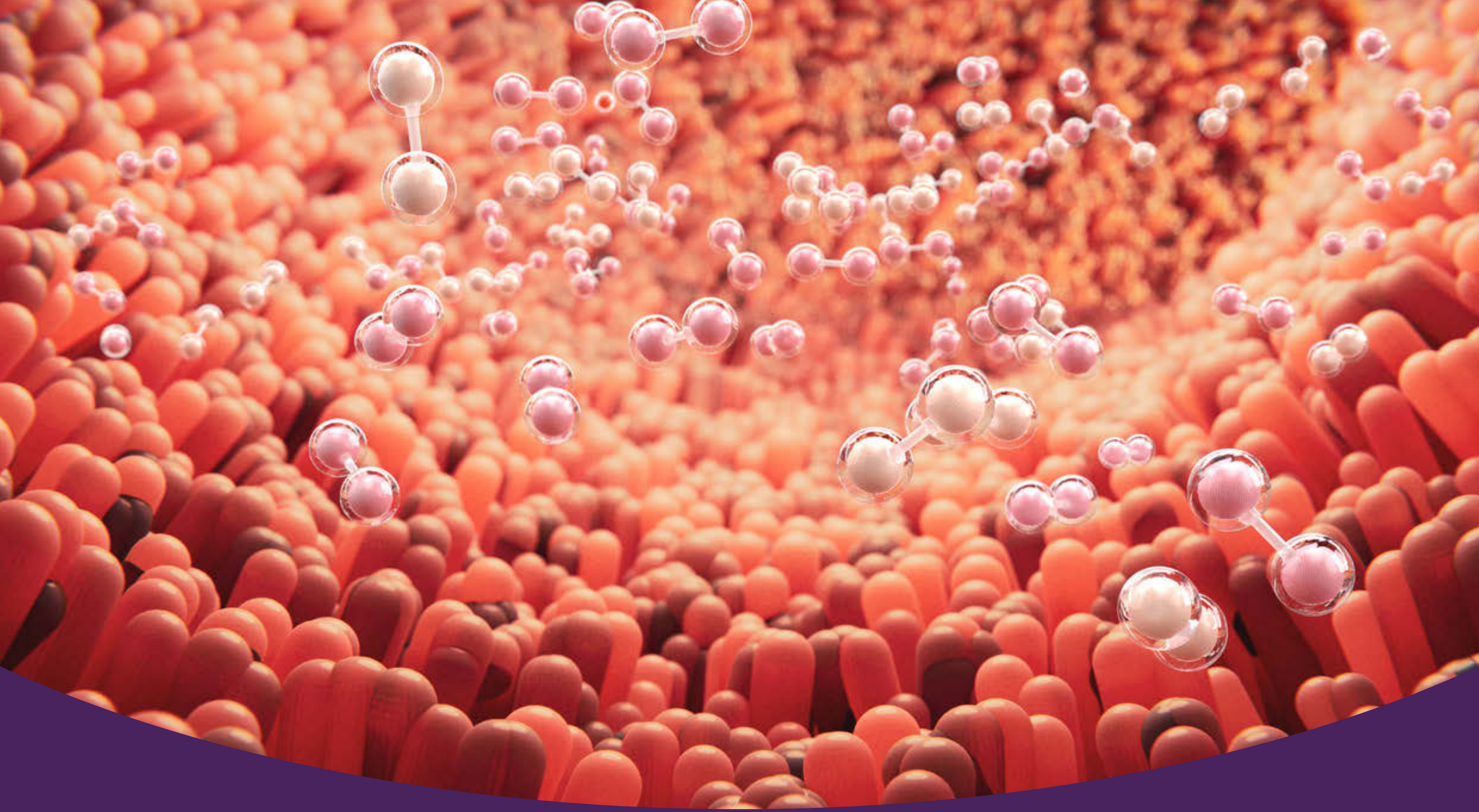
Antimicrobial peptides help maintain the barrier function and prevent potentially harmful substances entering the body



The gut microbiome itself contributes to intestinal health by supporting nutrient metabolism, enhancing epithelial barrier function, and promoting resistance to pathogenic bacteria through competition for nutrients and stimulation of IgA and AMP production (Sekirov et al., 2010). Microbial fermentation of undigested protein and dietary fibres produces metabolites such as SCFAs, including butyrate, which serve as an energy source for colonocytes and stimulate epithelial proliferation, maintaining intestinal integrity (Diether & Willing, 2019; Park et al., 2016). Fermentation of proteins can also produce potentially harmful compounds, such as ammonia, phenols, indoles, amines, and hydrogen sulphide, which may negatively affect colonocyte health and contribute to faecal odour (Diether & Willing, 2019).

Overall, the gastrointestinal system in cats is critical not only for digestion and nutrient absorption but also for maintaining robust and balanced immune function, highlighting the intricate interplay between the epithelium, mucus, immune cells, and the microbiome.





THE GUT MICROBIOME AND ITS ROLE IN FELINE DIGESTIVE HEALTH

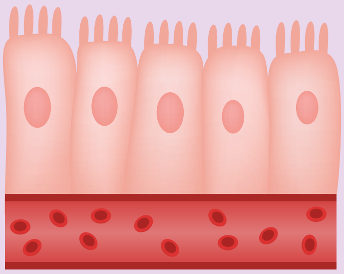
The gut microbiome in cats is composed of both beneficial and potentially harmful microorganisms, including bacteria, fungi, protozoa, and viruses. The largest and most diverse populations reside in the lower small intestine and, particularly, the large intestine (colon), with bacterial populations being the most extensively studied (Sekirov et al., 2010).

A healthy gut microbiome supports gastrointestinal cells nutritionally, contributes to the maintenance of the epithelial barrier, and enhances immune function. Commensal bacteria form an integral component of the intestinal physical barrier by competing with pathogenic microbes for nutrients, occupying attachment sites, and stimulating the production of antimicrobial factors such as secretory IgA and antimicrobial peptides (AMPs) by epithelial and immune cells (Sekirov et al., 2010; Camilleri et al., 2019).

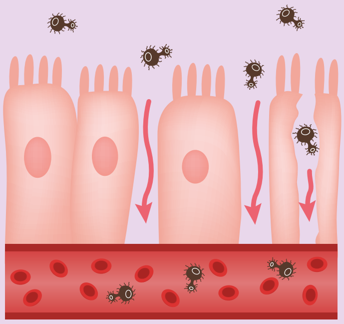
Maintaining a balanced gut microbiome is therefore essential for cats to optimise nutrient absorption, support the epithelial barrier, and regulate immune function. Diets formulated with specific ingredients and processes, such as prebiotic supplementation, can help promote beneficial bacterial populations, enhance SCFA production, and support overall digestive health and barrier function (Aguilar-Toalá et al., 2025; WSAVA, 2020).

INTESTINAL EPITHELIAL CELLS

The intestinal epithelial cells form tight links (known as tight junctions) between the cells, which help to maintain the barrier function and stop potentially harmful substances from the environment from entering the body.



Normal tight junctions serve to protect against harmful substances from the environment entering the body through the bloodstream.



Leaky, inflamed, or damaged junctions may potentially fail to prevent harmful substances from entering the body.

THE IMPORTANCE OF BIOAVAILABLE AND BIOACTIVE PEPTIDES TO SUPPORT DIGESTIVE HEALTH

Proteins are large macromolecules composed of individual amino acids, which act as the building blocks for new proteins such as muscle, skin, hair, enzymes, antibodies, and hormones (Hall et al., 2021).

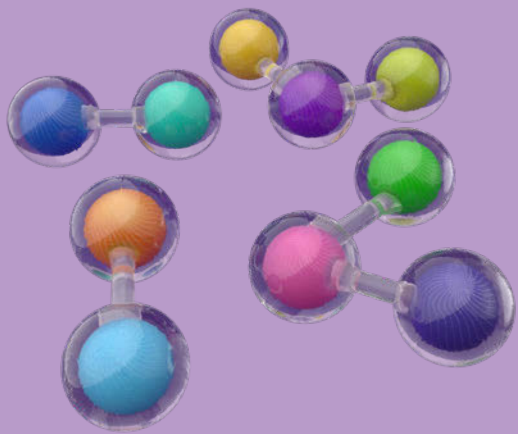
In cats, protein digestion begins in the stomach and continues in the small intestine, where enzymes break down dietary proteins into smaller peptides and free amino acids. These protein hydrolysates are then absorbed by the intestinal epithelium, enabling the synthesis of new proteins in the body (Goodman, 2010).

Historically, it was believed that only free amino acids were absorbed via specific transporters. However, most amino acids are now recognised to be absorbed as di- and tri-peptides via the broad-specificity transporter PepT1, which efficiently transports small peptides across enterocytes (Fei et al., 1994).

Peptide-based protein sources are absorbed more readily than intact proteins or free amino acids, reducing the amount of undigested protein reaching the colon and thereby limiting the production of potentially harmful bacterial metabolites such as ammonia, phenols, and indoles (Maebuchi et al., 2007; Zhao et al., 1997; Diether & Willing, 2019).

Intestinal epithelial cells in cats have a rapid turnover, with a typical lifespan of approximately 3–5 days. An equilibrium exists in a healthy gut between cell loss at the tip of the villus and the generation of new cells in the crypts, which migrate upwards to replace shed cells (Williams et al., 2015). Disruption of this balance due to inflammation, infection, or other insults can impair epithelial renewal.

Peptides derived from dietary proteins have been shown to stimulate epithelial proliferation and differentiation via receptors such as GPR93, activating intracellular signalling pathways that support repair and barrier function (Choi et al., 2007; Fitzgerald et al., 2005). In vitro and in vivo studies have demonstrated that these peptides enhance cell proliferation, migration, and recovery following intestinal injury, contributing to the maintenance of epithelial integrity (Fitzgerald et al., 2005; Marchbank et al., 2009).



CELL REPAIR

In cats, the cells that line the gut have a lifespan of only about 3 to 5 days. The body constantly replaces them by making new cells at the base of the gut lining, which then move upward to take the place of old cells that are shed. When this balance is disturbed, for example by inflammation or infection, the gut may struggle to repair itself properly.

Peptides derived from dietary protein can help the gut lining heal. They activate certain receptors in the gut that send signals to support repair and strengthen the gut's protective barrier. Studies have shown that these peptides help gut cells grow, move to where they're needed, and recover after injury, helping the gut lining stay healthy and intact.

BIOACTIVE PEPTIDES SUPPORT DIGESTIVE HEALTH IN CATS

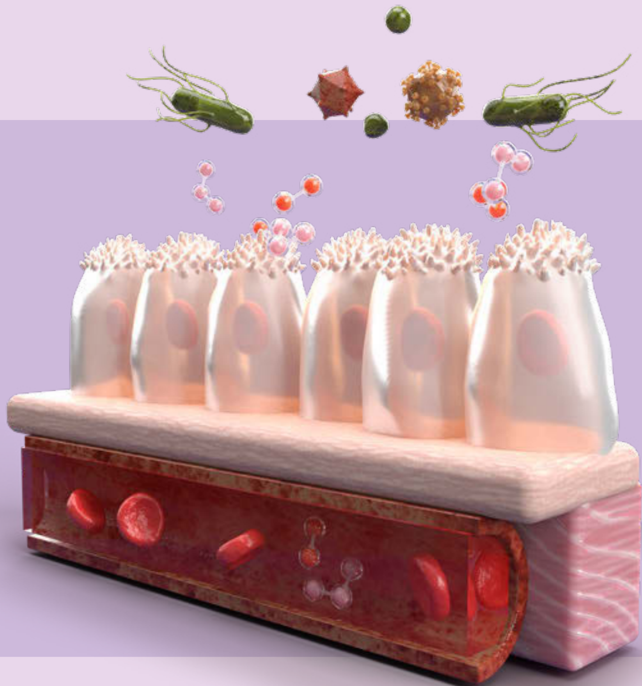
A 2024 study investigated the effects of diets supplemented with bioactive peptides on 12 adult cats, focusing on nutrient digestibility, faecal characteristics, gut microbiota, and immune function. The researchers measured apparent total tract digestibility (ATTD) and found that bioactive peptides at 4% inclusion significantly improved digestibility of dry matter and organic matter, indicating enhanced nutrient utilisation.

While overall faecal consistency and major metabolite profiles remained unchanged, subtle shifts in gut microbiota were observed, including increased relative abundance of beneficial genera such as Bifidobacterium. These findings suggest that bioactive peptides can modulate the gut microbial community and support digestive efficiency. No adverse health effects were reported, demonstrating that bioactive peptides are safe for dietary inclusion at tested levels. Immune responses and stress markers were largely unaffected, indicating that digestive benefits can occur independently of systemic immune modulation. Overall, this study provides in vivo evidence that dietary bioactive peptides can improve nutrient absorption and positively influence gut microbiota composition, supporting their role as functional ingredients for digestive health (Oba, et al., 2024).

Overall, dietary proteins and bioactive peptides including collagen peptides play a vital role in feline gut health by providing essential amino acids, stimulating intestinal epithelial proliferation, maintaining tight junction integrity, and supporting the repair and resilience of the intestinal barrier. This highlights the importance of high-quality, digestible protein sources in cat diets to optimise digestive efficiency and overall gastrointestinal health.

Bifidobacterium

COLLAGEN PEPTIDES AND DIGESTIVE HEALTH



WHY ARE INTESTINAL EPITHELIAL CELLS IMPORTANT?

The intestinal epithelial cells are connected by tight junctions, which regulate the passage of substances across the epithelium and prevent the translocation of pathogens and toxins (Chelakkot et al., 2018). Damage to these tight junctions from infection, inflammation, or dietary stress can compromise the intestinal barrier, potentially leading to gastrointestinal disorders and systemic effects.

Collagen peptides are particularly rich in the amino acids glycine, proline, and hydroxyproline, which together form a large proportion of collagen protein (approximately 57%) (Roles of dietary glycine, proline, and hydroxyproline, 2017). These amino acids are essential for the structure of connective tissues, including the gut lining, and help maintain the integrity of the intestinal mucosa.

In cell-based models of barrier dysfunction, **collagen peptides have been shown to strengthen tight junctions**; for example, in Caco-2 monolayers treated with inflammatory stimuli, certain low molecular weight collagen peptides restored levels of tight junction proteins ZO-1 and occludin and inhibited inflammatory signalling pathways (Chen et al., 2017). Specific peptide sequences derived from collagen have also been demonstrated to reduce epithelial permeability, limiting the passage of markers across the barrier more effectively than free amino acids like glutamine or arginine (Song et al., 2019).

More broadly, research has shown that food-derived peptides can positively influence tight junction integrity: dairy-derived peptides reduce epithelial permeability and increase occludin expression in human intestinal cell models (Tanabe et al., 2006; Yasumatsu & Tanabe, 2010), while poultry-derived peptides increase tight junction protein levels and downregulate pro-inflammatory cytokines in animal models, protecting the intestinal barrier and alleviating colitis (Li et al., 2020). Animal-derived peptides, including collagen, have also been associated with reduced disease activity and tissue damage, likely through modulation of cytokine profiles and upregulation of antioxidant genes, further supporting intestinal repair and epithelial homeostasis (Wei et al., 2022).

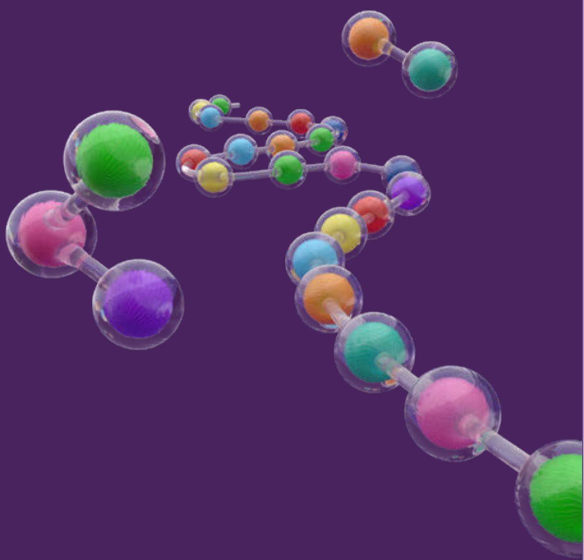
By reinforcing tight junctions and reducing epithelial permeability, collagen peptides may help prevent or mitigate "leaky gut", a condition in which the intestinal barrier becomes permeable to harmful molecules, bacteria, or toxins, provoking inflammation. For cats, whose gut health is critical for nutrient absorption and overall well-being, supplemental collagen peptides may therefore support gut barrier resilience, reduce the risk of barrier disruption, and contribute to long-term digestive health (Oba et al., 2024).

HOW HYDROLYSED PROTEINS HELP CATS WITH FOOD ALLERGIES

Hydrolysed protein diets help reduce food-related allergic reactions in cats by breaking down intact proteins into smaller peptide fragments, which are less likely to be recognised by the immune system.

BREAKING DOWN OF PROTEIN FOR THE POSITIVE EFFECT

The ability of a protein to induce an immune-mediated hypersensitivity (allergic) response is largely dependent on its size and structure (Cave, 2006). By using controlled enzymatic hydrolysis, proteins can be partially or extensively broken down into smaller peptides that are too small to be detected by the immune system, giving hydrolysed proteins a lower allergenic potential.



HYDROLYSED PROTEIN HELPS REDUCE FOOD-RELATED ALLERGIC REACTIONS

Ensuring that **a hydrolysate contains no peptides greater than 3 kDa, or ideally 1 kDa**, maximises the chance of eliminating residual allergens (Cave, 2006).

Clinical studies confirm the efficacy of this approach in cats: for example, hydrolysed salmon-and-pea diets significantly reduced clinical signs of cutaneous adverse food reactions, such as pruritus and skin lesions (Crouch et al., 2022). In cats with chronic enteropathy, feeding a hydrolysed protein diet not only helped resolve gastrointestinal signs but also positively influenced the gut microbiota, increasing beneficial bacteria such as Bifidobacterium and reducing inflammation-associated species (Bilzer et al., 2022).

By reducing the immune burden from dietary antigens, **hydrolysed protein diets support a more stable and less inflamed gut environment, which in turn improves nutrient absorption and overall digestive health in cats** (Purina Institute, 2024; Oba et al., 2024).

WHAT MAKES THE GASTROINTESTINAL DIGESTIVE CARE RECIPE SO UNIQUE?

The development and formulation of the Gastrointestinal Digestive Care recipe has been centred around the 'Power of Peptides' using the latest Freshtrusion HDP technology.

HDP freshtrusion HIGHLY DIGESTIBLE PROTEIN

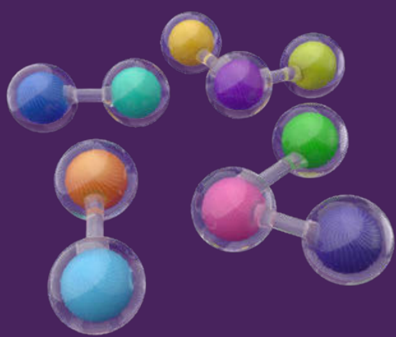
Freshtrusion HDP (Highly Digestible Protein) is the unique process of cooking fresh meat and fish ingredients in the presence of a natural enzyme, which digests (hydrolyses) the protein into a mixture of peptides and free amino acids.

This increases the digestibility and bioavailability of the protein and improves palatability, through what we like to refer it as Goldilocks Principle:

THE GOLDILOCKS PRINCIPLE

Instinctively, it would be assumed that intact protein would be best for a cat to digest as it contains all the nutritional elements together as one. Similarly, individual amino acids, broken down as small as possible, might be considered to be much easier to absorb. However, it has been proven in research studies that the ideal digestibility and absorption rates occur in small-chain peptides (≤ 3kDa). We like to refer to this as the 'Goldilocks principle'.

INTACT PROTEIN

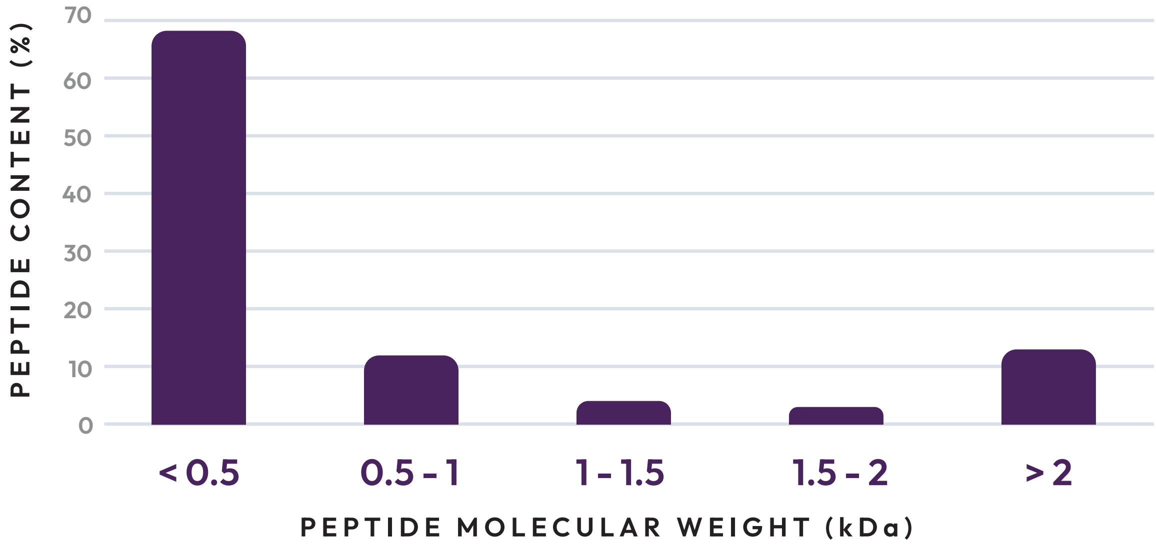


DI AND TRI-PEPTIDES

SINGULAR AMINO ACIDS

TOO BIG | JUST RIGHT | TOO LITTLE

GASTROINTESTINAL DIGESTIVE CARE RECIPE: PEPTIDE CONTENT (%)



A minimum of 68% of the peptides in this recipe are < 0.5 kDa with just 13% of the peptides > 2 kDa

These results show the majority of peptides in the finished kibble fall into the < 0.5 kDa category, which includes the highly digestible and nutritionally beneficial dipeptides and tripeptides - achieving the Goldilocks Principle.

THE POWER OF THE PEPTIDES FOR DIGESTIVE HEALTH

- ✔ Increases the digestibility and bioavailability of the protein
- ✔ Improves the palatability of the recipe
- ✔ Ensures an ideal supply of amino acid building blocks to support renewal of intestinal epithelial cells
- ✔ Helps maintain effective intestinal barrier function by increasing tight junction protein levels
- ✔ Reduces the allergenic potential of the protein to aid sensitive digestion

WHAT OTHER INGREDIENTS ARE BENEFICIAL IN SUPPORTING DIGESTIVE HEALTH?

Prebiotics – MOS & FOS

Prebiotics, such as MOS (mannan-oligosaccharides) and FOS (fructo-oligosaccharides), are non-digestible dietary fibres that selectively stimulate the growth and activity of beneficial gut bacteria.

In cats, t**hese prebiotics support digestive health by serving as a food source for beneficial bacteria such as Bifidobacterium and Lactobacillus, helping to maintain a balanced intestinal microbiota** (Gibson et al., 2017).

FOS is fermented by these bacteria in the colon, producing short-chain fatty acids (SCFAs) that provide energy to colon cells, help maintain mucosal integrity, and lower intestinal pH to inhibit pathogenic bacteria (Swanson et al., 2002). MOS functions differently by binding to harmful bacteria, such as E. coli and Salmonella, preventing them from adhering to the intestinal lining and reducing the risk of gastrointestinal infections (Spring et al., 2000). By promoting a balanced gut microbiota, prebiotics also help regulate the immune system and reduce intestinal inflammation.

Additionally, **MOS and FOS can improve stool quality and regularity, support normal intestinal transit and help to prevent constipation or diarrhoea**. Overall, these prebiotics help maintain a resilient gastrointestinal system in cats, supporting both digestive efficiency and overall well-being.

Cellulose

Cellulose, a type of insoluble dietary fibre, plays an important role in supporting digestive health in cats, despite cats being obligate carnivores with a relatively short gastrointestinal tract. **One of its primary benefits is the regulation of intestinal transit.** By adding bulk to the stool, cellulose stimulates peristalsis - the wave-like contractions of the intestines - which helps food move efficiently through the digestive tract and can prevent constipation (Fascetti & Delaney, 2022).

Although cellulose is largely insoluble and minimally fermentable, **it can indirectly support the gut microbiota by helping to maintain a healthy intestinal environment**. Small amounts of fermentation may occur in the colon, producing short-chain fatty acids (SCFAs) such as acetate. These SCFAs provide energy to colonocytes and help maintain mucosal integrity, which contributes to overall gastrointestinal health (Swanson et al., 2002). Additionally, cellulose helps improve stool quality by firming the faeces, making them easier to pass. This is particularly beneficial for cats prone to diarrhoea or soft stools, as it promotes regularity and comfort.

Another important benefit of cellulose for cats is its role in hairball management. By increasing faecal bulk and stimulating intestinal motility, cellulose can help move ingested hair through the digestive tract more efficiently, reducing the formation of hairballs and the risk of hair-related blockages in the stomach and intestines (Fascetti & Delaney, 2022).

Beyond its effects on digestion, **cellulose can also contribute to satiety, which may assist in weight management**. By increasing the feeling of fullness, cats consuming diets containing cellulose may regulate their food intake more effectively, reducing the risk of digestive overload associated with overeating (Fascetti & Delaney, 2022). Importantly, cellulose is well tolerated by cats because it is minimally digestible and does not contribute to fluctuations in blood glucose.

Overall, cellulose supports feline digestive health by promoting normal intestinal transit, improving stool quality, maintaining mucosal integrity, aiding in hairball prevention, and indirectly supporting a healthy gut microbiota. Even in obligate carnivores, the inclusion of small amounts of insoluble fibre such as cellulose can help maintain digestive efficiency and gastrointestinal well-being.

WHAT ARE THE RESULTS?

As part of the development of the Gastrointestinal Care recipe, an independent study was conducted to assess the apparent protein digestibility of diet and then compare this to the FEDIAF standard: 80% protein digestibility.

The study was conducted by the West Pomeranian University of Technology in Szczecin, Poland, led by researchers from the Faculty of Biotechnology and Animal Husbandry. They evaluated the digestibility of a test diet in a panel of cats fed under controlled conditions in home environments, ensuring accurate and ethically monitored data on feline protein digestibility.

The study involved a panel of 10 healthy adult cats and was conducted over 2 weeks, before the main data collection phase, the cats underwent a 7-day transition period to the test diet, during which their usual food was gradually replaced with the test diet. Following the adaptation week, a 7-day main collection period was conducted during which all faeces were collected and dietary intake was recorded daily. Owners were provided with sterile, pre-labelled containers and written instructions for sample collection and storage. At the end of the 7 days, all samples were transported to the laboratory on dry ice and stored at −20 °C until analysis. To evaluate apparent protein digestibility, the total protein intake for each cat during the 7-day main period was calculated from the daily food intake records and the diet's crude protein concentration on a dry matter basis. Faecal protein excretion was determined using the faecal dry matter content and its crude protein concentration.

Apparent protein digestibility (%) was then calculated for each cat using the formula:

[(protein intake – fecal protein excreted) / protein intake] × 100.

This method provided a robust and practical assessment of the apparent protein digestibility of the test diet under normal home-feeding conditions. Digestive Care achieved 92% protein digestibility - far exceeding FEDIAF's 80% standard.

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